From: Nancy Dorsey
To: Q"Keller G. Randy"
Cc: Austin Holland A.; Kyle Murray E.; Dellinger.Philip@EPA.GOV; Omar Martinez
Subject: Re: URGENT
Date: 12/19/2012 04:54 PM

Thank you Randy. With respect to two ii, it has worked in some places, but you are correct that it isn't by any means guaranteed to be effective.

Normally, when conditions are added to a permit, the operator is required to come up with the additional equipment and to run the required tests. Obviously, seismometers would really only be helpful if they are hooked into a network where experienced folks actually monitor and analyze the results. Hence the suggestions that OGS be involved from the beginning especially for any discussions of equipment, monitoring or appropriate action levels.

Nancy

▼ "Keller G. Randy" ---12/19/2012 04:18:21 PM---Hi Nancy: We have not been ignoring you, but this time of year is really busy that the university, a

From: "Keller G. Randy" <grkeller@ou.edu>
To: Nancy Dorsey/R6/USEPA/US@EPA
Cc: Austin Holland A. <austin.holland@ou.edu>, Kyle Murray E. <KYLE.MURRAY@ou.edu>
Date: 12/19/2012 04:18 PM
Subject: Re: URGENT

Hi Nancy: We have not been ignoring you, but this time of year is really busy that the university, and needed to consult my colleagues.

We are certainly willing to help in regard to monitoring seismicity as outlined in the document. However, we and our instruments are spread very thin so the operator would need to provide some modest support if we were going to do the seismic monitoring. We also have expertise in regard to the water monitoring in item 1b.

Item 2ii may be problematic because some researchers suggest changes in pressure may help trigger earthquakes (Talwani 2007). It will have the effect of slightly reducing overall pressures somewhat depending on injection formation properties. If the formation has high transmissivity and storativity this would have little effect on overall pressure.

We hope this input is helpful.

Best regards, Randy Keller

G. Randy Keller
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On Dec 19, 2012, at 11:21 AM, Dorsey.Nancy@epamail.epa.gov wrote:

> Your office suggested I e-mail again, letting you know it was urgent. The EPA will be sending out our letter to ODEQ this week (before COB 12/21). We have suggested in several places that OGS should be consulted for appropriate details. As such, we would really like to be sure that you are not surprised and that you are okay with the language. I have pasted it below for your easy access. If you have any questions, please call me at 214-665-2294.
>
> The formatting does not work well in Lotus Notes. The a's are indented below the preceding section, I tried to force the next level to indent.

1. Given the limited geologic understanding, fall-off test evidence of nearby boundary conditions, and the proximity to an area exhibiting recent seismic activity, the following additional permit requirements are recommended:
   a. Continuous recording of injection rate and pressure, as required under 40 CFR146.13(b)(2). The results should be provided to ODEQ at a pre-defined timing, as both daily averages and plotted in a Hall plot in Excel or a similar spreadsheet.
   b. An annual fluid profile test to verify where the injected fluid is leaving the wellbore. This should be either a temperature survey or a radioactive tracer depending on required clarity of the results.
   c. Set-up and provide continuous monitoring of sufficient seismometers to identify the specific source of any new seismicity in the immediate area. These should be in-place prior to injection. The Oklahoma Geologic Survey geophysical observatory staff will be your best resource for specific details.

2. Create a contingency plan in the permit for required actions to be followed in case seismic activity is identified in the immediate area. These would use threshold events to trigger specific actions, such as the following examples:
   a. Increasing frequency or clusters of small detected seismic events in the area.
      i. Increase monitoring frequency of injection parameters, such as formation pressure and rates, and increase frequency of

reporting of the information to ODEQ.

b. Any events above a pre-defined background level, up to magnitudes felt only in the immediate area.

i. Increase monitoring of fluid specific gravity, since the density impacts the bottomhole pressure in the well.

c. Events felt at a greater distance, with no reported damage.

i. Reduce the injection rate

ii. Inject intermittently to allow time for pressure dissipation, with the amount of shut-in time needed being site-specific

d. Events that cause damage

i. Cease injection

thank you,

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